

## **LISTING OF THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**1. (Currently Amended)** A network control device for a network system including a plurality of sub-networks having different kinds of network architectures and a plurality of network nodes, the network control device comprising:

a relay service efficiency promoting section which reduces physical and procedural constraints on a ~~gate-way~~ gateway mechanism at the time when the ~~gate-way~~ gateway mechanism executes a service of relaying at least one of a message, a dialog and a response directed to link objects operating on network nodes belonging to said sub-networks in the network system,

each said relay service efficiency promoting section having a service registry provided on said ~~gate-way~~ gateway to store information necessary for accessing a service on another sub-network, wherein said service registry shares said information autonomously with another service registry in another network control device belonging to another sub-network by transmitting said information to each other

wherein said plurality of sub-networks comprise an information system network, an operation system network, a wireless interconnect and a plurality of lines of portable apparatus interconnects, wherein a plurality of service nodes having a gateway function and a first and a second gateways connected with each other are connected to said information system network, wherein said second gateway and a plurality of service nodes are connected to said operation system network, wherein said first gateway and an additional service node, other than said service nodes, are connected to said wireless interconnect, and wherein a plurality of portable apparatuses are connected to the plurality of lines of portable apparatus interconnects.

**2. (Currently Amended)** The network control device as set forth in claim 1, wherein said relay service efficiency promoting section has a service proxy provided on said ~~gate way~~ gateway, said service proxy having a mechanism of relaying and standing proxy for

processing to be executed at the time of requesting processing from a service on another sub-network.

**3. (Canceled)**

**4. (Currently Amended)** The network control device as set forth in claim 1, wherein said relay service efficiency promoting section is operable to analyze a service request and conducting message conversion on said ~~gate-way~~ gateway.

**5. - 6. (Canceled)**

**7. (Currently Amended)** A network control device for a network system including a plurality of sub-networks having different kinds of network architectures and a plurality of network nodes, the network control device comprising:

a relay service efficiency promoting section which reduces physical and procedural constraints on a ~~gate-way~~ gateway mechanism at the time when the ~~gate-way~~ gateway mechanism executes a service of relaying at least one of a message, a dialog and a response directed to link objects operating on network nodes belonging to said sub-networks in the network system,

wherein, when said relaying is conducted between said sub-networks connected in cascade, said relay service efficiency promoting section includes a message transfer mechanism, and wherein said plurality of sub-networks comprise an information system network, an operation system network, a wireless interconnect and a plurality of lines of portable apparatus interconnects, a plurality of service nodes having a ~~gate-way~~ gateway function and a first and a second ~~gate-ways~~ gateways connected with each other being connected to said information system network, said second ~~gate-way~~ gateway and said plurality of service nodes being connected to said operation system network, said first ~~gate-way~~ gateway and an additional service node being connected to said wireless interconnect, and a plurality of portable apparatuses being connected to the plurality of lines of portable apparatus interconnects.

**8. - 9. (Canceled)**

**10. (Currently Amended)** A network control device for a network system including a plurality of sub-networks having different kinds of network architectures and a plurality of network nodes, the network control device comprising:

a relay service efficiency promoting section which reduces physical and procedural constraints on a ~~gate-way~~ gateway mechanism at the time when the ~~gate-way~~ gateway mechanism executes a service of relaying at least one of a message, a dialog and a response directed to link objects operating on network nodes belonging to said sub-networks in the network system,

said relay service efficiency promoting section having a virtual machine as a mechanism for executing a portable code independent of execution environments mounted on said ~~gate-way~~ gateway, said virtual machine being operable to load and execute a protocol-dependent portion of a service proxy through the network system,

wherein said plurality of sub-networks comprise an information system network, an operation system network, a wireless interconnect and a plurality of lines of portable apparatus interconnects, a plurality of service nodes having a ~~gate-way~~ gateway function and a first and a second ~~gate-ways~~ gateways connected with each other being connected to said information system network, said second ~~gate-way~~ gateway and said plurality of service nodes being connected to said operation system network, said first ~~gate-way~~ gateway and an additional service node being connected to said wireless interconnect, and a plurality of portable apparatuses being connected to the plurality of lines of portable apparatus interconnects.

**11. - 12. (Canceled)**

**13. (Currently Amended)** A network control device, comprising:  
a sub-network node including

- an information system network,
- an operation system network,
- a wireless interconnect,
- a plurality of lines of portable apparatus interconnects,

first, second and third sub-networks mounted with different kinds of protocols/profiles, processing of a physical layer and a data link layer being protocols of the first, second and third sub-networks, and

a first ~~gate-way~~ gateway/proxy which connects said first and said third sub-networks and a second ~~gate-way~~ gateway/proxy which connects said second and said third sub-networks;

a common transport layer; and

a service proxy and a client proxy both being shared by said first and said third sub-networks.

**14. (Previously Presented)** The network control device as set forth in claim 13, wherein first and second service message conversion processing and message forwarding processing are performed in response to connection between said first, said second and said third sub-networks under the control of said service proxy and said client proxy.

**15. (Currently Amended)** The network control device as set forth in claim 13, wherein a property holding service registry for a service existing on a network formed by said first, said second and said third sub-networks is arranged on each of said first and said second ~~gate-ways~~ gateways.

**16. (Currently Amended)** The network control device as set forth in claim 13, wherein said first and said second ~~gate-way~~ gateway/proxies have portions for executing processing dependent on a service of said service proxy described with a portable code independent of execution environments, and wherein said first and said second ~~gate-way~~ gateway/proxies include a virtual machine/execution environment for executing said service-dependent processing.

**17. (Currently Amended)** A network control method for a network system including a plurality of sub-networks having different kinds of network architectures and a relay service efficiency promoting section which reduces physical and procedural constraints on a ~~gate way~~ gateway mechanism at the time when the ~~gate-way~~ gateway mechanism executes a service

of relaying at least one of a message, a dialog and a response directed to link objects operating on network nodes belonging to said sub-networks, the method comprising:

initializing the network system using said relay service efficiency promoting section, in a case where relaying is conducted between said sub-networks connected in cascade said step of initializing including determination of a physical layer address, determination of a logical address in said sub-networks, activation of a network management service and activation of an applied service using a message transfer mechanism;

registering a service to be brought public among services of said sub-networks to another sub-network;

utilizing the registered service; and

erasing registration of said registered service after the utilization of said service.

**18. (Currently Amended)** The network control method as set forth in claim 17, wherein said service registration step includes processing a procedure on a service node in which a service to be registered is included and processing a procedure of a service registry on a ~~gate-way~~ gateway node paired with the service node.

**19. (Previously Presented)** The network control method as set forth in claim 18, wherein said processing a procedure on the service node includes:

a step of confirming whether the service is already registered in a service registry node,

a registry registration initialization step conducted with respect to said service node when the registration is yet to be completed,

a step of transmitting a service registry registration request to said service registry node,

and

a step of, upon receiving a registration request acceptance notification from said service registry node, transmitting registry registration information to said service registry node.

**20. (Previously Presented)** The network control method as set forth in claim 18, wherein said processing the procedure of the service registry includes:

a registry registration initialization step to be conducted by said service registry node after activation,

a step of waiting for a registry registration request from said service node,  
a step of receiving a service registration request transmitted from said service node side to accept the registration request,  
a step of notifying said service node as a requesting source that registration of the service is permitted to execute registry registration of receiving registry registration information from said service node side and issuing a registration completion notification to said service node side, and  
a step of, upon completion of registration of all the services to be brought to be public to another sub-network, transmitting information to be held in a service registry on the other sub-network to the service registry to end the processing.

**21. (Previously Presented)** The network control method as set forth in claim 18, wherein said step of utilizing the registered service includes a service using step of a service using node, a service search step in a service registry on a service using side sub-network, a service using step of a user side service proxy, a service using step of a service providing side service proxy and a service using step of a service providing side service node.

**22. (Previously Presented)** The network control method as set forth in claim 21, wherein said service using processing of a service using node includes the steps of: transmitting a service search request to a service registry for the search of a service to be used with the entire network as a target,  
selecting an optimal service based on a search result received from said service registry to determine a service and a proxy on a desired sub-network,  
issuing a service request to the determined service proxy from the service using node to wait for return of a result of the service and, upon return of a result of said service from said service proxy, proceeding with the processing, and  
repeating the same processing when requesting the same service again and ending the processing when the service is not used.

**23. (Previously Presented)** The network control method as set forth in claim 22, wherein said processing of waiting for a service result to be returned includes issuance

of a service request to said determined service proxy from the service using node and issuance of information corresponding to a necessary request.

**24. (Previously Presented)** The network control method as set forth in claim 21, wherein said service search processing in said service registry includes the steps of:  
receiving said service search request from said service using node by said service registry on the user side to search for registry information in the owned node,  
returning service information relevant to a search key obtained as a result of the search to software of said service using node, and  
completing the search by said service registry and waiting for a next search request.

**25. (Previously Presented)** The network control method as set forth in claim 21, wherein said service using processing includes:  
a service using step at the user side service proxy linking services on different sub-networks, and  
a service using step at the provider side service proxy.

**26. (Previously Presented)** The network control method as set forth in claim 21, wherein until the end of the service, said service using processing at said user side service proxy further comprises:  
a step of monitoring a service request made from a node in a sub-network belonging to said service using side proxy,  
a step by said user side service proxy of, upon receiving a service request, interpreting the service request and after conducting predetermined message conversion, transferring the message to a provider side service proxy to which a node providing the service belongs and monitoring arrival of a service execution result after the transfer, and  
a step of, upon receiving said service execution result from said provider side service proxy, conducting message conversion to transmit the message to a service proxy designated by the service requesting side node.

**27. (Previously Presented)** The network control method as set forth in claim 21, wherein until the end of the service, said service using processing at said provider side service proxy further comprises the steps of:

monitoring a service request made from said user side service proxy,  
upon receiving said service request, interpreting the service request,  
converting the request into a message system on the owned sub-network and transferring the message to a provider side node,  
thereafter monitoring arrival of a service execution result from said provider side node,  
and  
upon receiving said service execution result, converting the result into a message to transmit the message toward a service proxy designated by said service requesting node.

**28. (Original)** The network control method as set forth in claim 21, wherein the service using processing of the service provider side service node includes the steps of:

monitoring arrival of a service request,  
upon arrival of said service request, interpreting a request message to execute a service to be provided, and  
returning an execution result to a service proxy on a transmission source's own sub-network to end the steps of one service request.

**29. (Currently Amended)** A network control method for a network system including sub-networks having different kinds of network architectures and a relay service efficiency promoting section which reduces physical and procedural constraints on a ~~gate-way~~ gateway mechanism at the time when the ~~gate-way~~ gateway mechanism executes a service of relaying at least one of a message, a dialog and a response directed to link objects operating on network nodes belonging to said sub-networks in the network system, the method comprising:

sending a converted message to a target sub-network using said relay service efficiency promoting section, in a case where relaying is conducted between said sub-networks connected in cascade, by a message forwarding function included in a message transfer mechanism of the relay service efficiency promoting section, wherein said sending of the converted message is accomplished at the time of service linkage between sub-networks not directly connected by a



network topology to conduct a service between a service using node and a service providing node on the target sub-network without repeating message conversion.

**30. (Currently Amended)** The network control method as set forth in claim 18, wherein said relay service efficiency promoting section further includes a virtual machine as a mechanism for executing a predetermined portable code mounted on the ~~gate-way~~ gateway, when a function of loading and executing a protocol-dependent portion of a service proxy on said ~~gate-way~~ gateway through the network is provided, said processing of a procedure on the service node comprising:

- a step of confirming whether the service is already registered in a service registry node,
- an initialization step of registration in a registry and registration of service-dependent processing codes of said service proxy and client proxy to be conducted with respect to said service node when the registration is yet to be completed,

- a step of transmitting a service registry registration request to said service registry node,
- and

- a step of, upon receiving a registration request acceptance notification from said service registry node, transmitting registry registration information and the portable codes of the service-dependent processing of the service proxy and the client proxy to said service registry node and when other service exists which is to be registered among services belonging to the node, repeating the same step to end the registration when the step is completed.

**31. (Currently Amended)** The network control method as set forth in claim 18, wherein the processing the procedure of the service registry includes:

- a registry registration initialization step to be conducted by the service registry on the ~~gate-way~~ gateway node after activation,

- a step of waiting for a registry registration request from said service node,

- a step of receiving a service registration request transmitted from said service node side to accept the registration request,

- a step of notifying said service node as a requesting source that registration of the service is permitted to execute each service registry and client registry registration of receiving registry registration information and a portable code of service-dependent processing of a service proxy

and a client proxy from said service node side and issuing a registration completion notification to said service node side, and

a step of, upon completion of registration of all the services to be brought to be public to other sub-network among said sub-networks, transmitting information to be held in a service registry on other sub-network to the service registry in question and transmitting the portable codes of said service proxy and client proxy to the corresponding said service proxy and said client proxy to end the processing.

**32. (Previously Presented)** A program recorded on a computer-readable medium and executable on a general purpose computer, the program causing the computer to execute procedure processing on a service node and comprising:

a function of confirming that a service in question is already registered in a registry,  
a registry registration initialization function to be conducted with respect to a service node when the registration is yet to be completed,

a function of transmitting a service registry registration request to a service registry node,  
and

a function of, upon receiving a registration request acceptance notification from said service registry node, transmitting registry registration information to said service registry node and when other service exists which is to be registered among services belonging to the node, repeating the same processing to end the registration when the processing is completed.

**33. (Previously Presented)** A program recorded on a computer-readable medium and executable on a general purpose computer, the program causing the computer to execute procedure processing of a service registry and comprising:

a registry registration initialization function to be conducted by a service registry node after activation,

a function of waiting for a registry registration request from a service node,

a function of receiving a service registration request transmitted from said service node side to accept the registration request,

a function of notifying said service node as a requesting source that registration of the service is possible to execute registry registration of receiving registry registration information

from said service node side and issuing a registration completion notification to said service node side, and

a function of, upon completion of registration of all the services to be brought to be public to other sub-network among said sub-networks, transmitting information, out of the contents, to be held in a service registry on other sub-network to the service registry in question to end the processing.

**34. (Previously Presented)** A program recorded on a computer-readable medium and executable on a general purpose computer, the program causing the computer to execute service using processing of a service using node and comprising the functions of:

transmitting a service search request to a service registry for the search of a service to be used with the entire network as a target,

selecting a service optimum for a purpose among service information of a search result received from said service registry to determine the service and a proxy on the corresponding owned sub-network,

issuing a service request to the determined service proxy from the service using node to wait for return of a result of the service thereafter, upon return of a result of said service from said service proxy,

referring to the contents to proceed with the processing, and

repeating the same processing when requesting the same service again and ending the processing when the service is not used.

**35. (Canceled)**

**36. (Previously Presented)** A program recorded on a computer-readable medium and executable on a general purpose computer, the program causing the computer to execute service using processing in a user side service proxy and comprising:

a function of monitoring a service request made from a node in a sub-network belonging to a service using side proxy,

a function by the user side service proxy of, upon receiving a service request, interpreting the service request and after conducting predetermined message conversion, transferring the

message to a provider side service proxy to which a node providing the service in question belongs and monitoring arrival of a service execution result after the transfer, and

a function of, upon receiving said service execution result from said provider side service proxy, conducting message conversion to transmit the message to a service proxy designated by the service requesting side node.

**37. (Previously Presented)** A program recorded on a computer-readable medium and executable on a general purpose computer, the program causing the computer to execute service using processing in a provider side service proxy and comprising the functions of:

monitoring a service request made from a user side service proxy,  
upon receiving said service request, interpreting the service request,  
converting the request into a message system on the owned sub-network and transferring the message to a provider side node,

thereafter monitoring arrival of a service execution result from said provider side node,  
and

upon receiving said service execution result, converting the result into a message to transmit the message toward a service proxy designated by said service requesting node.

**38. - 39. (Canceled)**